

WHAT IS CLAIMED IS:

1. A power supply apparatus for a vehicle, comprising:
a power feed portion including a power storage portion and a
5 power generating portion, the power storage portion including a
storage battery, the power storage portion and the power generating
portion transmitting and receiving electric power to and from each
other, the power feed portion feeding electric power to a plurality
of on-vehicle loads; and
10 a control portion for controlling the electric power fed from
the power feed portion to the on-vehicle loads;
wherein the control portion includes means for, in cases
where the sum of feedable electric power is smaller than the sum of
required electric power or in cases where an electric quantity
15 related to the sum of feedable electric power is smaller than an
electric quantity related to the sum of required electric power,
increasing the sum of feedable electric power or decreasing the sum
of required electric power, wherein the sum of feedable electric
power is equal to electric power which can be fed from the power
20 feed portion to the on-vehicle loads, and which contains electric
power generated by the power generating portion and electric
power feedable from the storage battery, and wherein the sum of
required electric power is equal to the sum of electric power
consumed by the on-vehicle loads.
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2. A power supply apparatus as recited in claim 1, wherein the

control portion includes means for, in cases where the discharge electric power of the storage battery exceeds a prescribed allowable maximum value or a prescribed reference value, increasing the generated electric power or decreasing the sum of required electric power.

3. A power supply apparatus as recited in claim 1, wherein the control portion includes means for, in cases where it is judged that the sum of feedable electric power or a near-future prediction value thereof exceeds the sum of required electric power or a near-future prediction value thereof, increasing the sum of feedable electric power or decreasing the sum of required electric power.

4. A power supply apparatus as recited in claim 3, wherein the control portion includes means for calculating the sum of required electric power or the near-future prediction value thereof on the basis of detected operating conditions of the vehicle or conditions of drive of the on-vehicle loads.

5. A power supply apparatus as recited in claim 1, wherein the control portion includes means for increasing the sum of feedable electric power by increasing the electric power generated by the power generating portion.

6. A power supply apparatus as recited in claim 5, wherein the control portion includes means for giving preference to increasing

the electric power generated by the power generating portion over decreasing the sum of required electric power.

7. A power supply apparatus as recited in claim 1, wherein the
5 control portion includes means for decreasing the sum of required electric power by suspending prescribed ones of the on-vehicle loads, reducing drive rates of the prescribed ones of the on-vehicle loads, or implementing change from continuous power feed to the prescribed ones of the on-vehicle loads to intermittent power feed
10 thereto on a temporally offset basis.

8. A power supply apparatus as recited in claim 1, wherein the control portion includes means for, in cases where the sum of feedable electric power exceeds the sum of required electric power,
15 decreasing the electric power generated by the power generating portion or recovering the sum of required electric power so as to converge charge and discharge electric power of the storage battery on zero while the amount of electric power remaining in the storage battery is in a prescribed range.

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9. A power supply apparatus as recited in claim 8, wherein the control portion includes means for giving preference to recovering the sum of required electric power over decreasing the electric power generated by the power generating portion.

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10. A power supply apparatus as recited in claim 1, wherein the

power storage portion includes a first storage battery for feeding electric power to a first on-vehicle load group, a second storage battery for feeding electric power to a second on-vehicle load group, and a DC-DC power converting portion for transmitting interchange electric power between the first and second storage batteries, and wherein the control portion includes means for adjusting electric power required by the first and second on-vehicle load groups, the electric power generated by the power generating portion, or the interchange electric power transmitted between the first and second storage batteries so that the sum of feedable electric power for the first on-vehicle load group will exceed the sum of required electric power on the first on-vehicle load group, and that the sum of feedable electric power for the second on-vehicle load group will exceed the sum of required electric power on the second on-vehicle load group.

11. A power supply apparatus as recited in claim 10, wherein the control portion includes means for giving preference to adjusting the electric power generated by the power generating portion over adjusting the interchange electric power.

12. A power supply apparatus as recited in claim 1, wherein the power storage portion includes a first storage battery for feeding electric power to a first on-vehicle load group, and a second storage battery for feeding electric power to a second on-vehicle load group, wherein the power generating portion includes a first AC-DC power

converting portion for transmitting and receiving electric power to
and from the first storage battery, and a second AC-DC power
converting portion for transmitting and receiving electric power to
and from the second storage battery, and wherein the control
5 portion includes means for adjusting electric power required by the
first and second on-vehicle load groups or electric power generated
by the first and second AC-DC power converting portions so that the
sum of feedable electric power for the first on-vehicle load group
will exceed the sum of required electric power on the first on-
10 vehicle load group, and that the sum of feedable electric power for
the second on-vehicle load group will exceed the sum of required
electric power on the second on-vehicle load group.

13. A power supply apparatus as recited in claim 1, wherein the
15 control portion includes means for, in cases where a command to
change the sum of required electric power is given and then the
resultant sum of required electric power is equal to or greater than
the sum of feedable electric power, permitting the execution of the
command to change the sum of required electric power at or after
20 the moment of instructing an increase in the sum of feedable
electric power or a decrease in the sum of required electric power
so that the sum of feedable electric power can exceed the resultant
sum of required electric power.

25 14. A power supply apparatus as recited in claim 13, wherein the
control portion includes means for, regarding ones of the on-vehicle

loads which can be driven at drive rates in prescribed ranges, driving the ones of the on-vehicle loads at the drive rates in the prescribed ranges when a command to drive the ones of the on-vehicle loads is given.

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15. A power supply apparatus as recited in claim 1, wherein the power generating portion includes an electric generator/motor driven by an engine, and wherein the control portion includes means for enabling the power storage portion to maintain a
10 discharge power quantity allowing the engine to start during a time interval except a first time period immediately after a given number of times of engine-start discharging of the power storage portion and a second time period for which the engine is starting.

15 16. A power supply apparatus as recited in claim 1, wherein the power generating portion includes an electric generator/motor driven by an engine, and wherein the control portion includes means for, in cases where suspension of the engine during a prescribed short time interval is predicted, storing a prescribed
20 portion of a discharge power quantity in the power storage portion before the engine is suspended.

17. A power supply apparatus as recited in claim 7, wherein the control portion includes means for suspending the prescribed ones
25 of the on-vehicle loads or reducing the drive rates of the prescribed ones of the on-vehicle loads to decrease the sum of required

electric power in an order opposite an importance-based order predetermined in accordance with the degrees of importance of the on-vehicle loads.

5 18. A power supply apparatus as recited in claim 17, wherein the control portion includes means for altering the importance-based order by a change pattern predetermined on the basis of detected vehicle operating conditions or drive conditions of the on-vehicle loads.

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19. A power supply apparatus as recited in claim 1, wherein the control portion includes means for, in cases where the electric power generated by the power generating portion is greater than the sum of required electric power by a prescribed value or more,
15 decreasing the electric power generated by the power generating portion or increasing the sum of required electric power.

20. A power supply apparatus as recited in claim 19, wherein the control portion includes means for, in cases where charge electric
20 power of the storage battery exceeds a prescribed allowable maximum value or a prescribed reference value, decreasing the electric power generated by the power generating portion or increasing the sum of required electric power.

25 21. A power supply apparatus for a vehicle, comprising:
a power feed portion including a power storage portion and a

power generating portion, the power storage portion including a
storage battery, the power storage portion and the power generating
portion transmitting and receiving electric power to and from each
other, the power feed portion feeding electric power to a plurality
5 of on-vehicle loads; and

a control portion for controlling the electric power fed from
the power feed portion to the on-vehicle loads;

wherein the control portion includes means for, in cases
where the sum of required electric power exhibits a variation,
10 detecting the variation in the sum of required electric power on the
basis of drive conditions of the on-vehicle loads or conditions of
currents, means for changing electric power generated by the
power generating portion in response to the detected variation, and
means for, in cases where an increase in the sum of required
15 electric power can not be met by an increase in the electric power
generated by the power generating portion, discharging the storage
battery to compensate for the difference therebetween, and wherein
the sum of required electric power is equal to the sum of electric
power consumed by all of electrically-powered loads including the
20 on-vehicle loads.

22. A power supply apparatus as recited in claim 10, wherein the
power generating portion includes an electric generator/motor
driven by an engine, and wherein the control portion includes
25 means for, in cases where the sum of feedable electric power is
smaller than the sum of required electric power or it is predicted

that the sum of feedable electric power is smaller than the sum of required electric power, giving preference to decreasing the sum of required electric power or adjusting the interchange electric power over starting the engine when the engine is at rest.

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23. A power supply apparatus as recited in claim 1, wherein the control portion includes means for calculating the sum of required electric power by adding a basic required required power value and a consumed power value, the basic required power value
10 corresponding to the rate of electric power fed to small-rating-power loads and prescribed important loads, the consumed power value corresponding to the total rate of consumption of electric power by the on-vehicle loads.

15 24. A power supply apparatus as recited in claim 1, wherein the control portion includes means for calculating or storing priority points of the on-vehicle loads which are as functions of basic points given to the on-vehicle loads for respective evaluation factors, and means for setting an order in which the sum of required electric
20 power is decreased in accordance with the magnitudes of the priority points.

25 25. A power supply apparatus as recited in claim 24, wherein the priority points or the basic points of prescribed ones of the on-vehicle loads are variable in time domain.

26. A power supply apparatus as recited in claim 24, wherein the control portion includes means for determining drive rates of the on-vehicle loads in accordance with the priority points thereof.

5 27. A power supply apparatus as recited in claim 1, wherein the control portion includes means for detecting whether or not the amount of electric power stored in the power storage portion is smaller than a prescribed value, and means for, when it is detected
10 that the amount of electric power stored in the power storage portion is smaller than the prescribed value, increasing the sum of feedable electric power or decreasing the sum of required electric power.

15 28. A power supply apparatus as recited in claim 1, wherein the control portion includes means for detecting whether or not the amount of electric power stored in the power storage portion is smaller than a prescribed value, and means for, when it is detected that the amount of electric power stored in the power storage
20 portion is not smaller than the prescribed value, decreasing the sum of feedable electric power.

29. A power supply apparatus as recited in claim 10, wherein the power generating portion includes an electric generator/motor driven by an engine, and wherein the control portion includes
25 means for, in cases where the position of the vehicle is judged to be in a prescribed engine-drive-regulated region on the basis of

information received from a vehicle position detecting device
provided on the vehicle or from an external with respect to the
vehicle or in response to an engine-drive-regulation signal received
from an external with respect to the vehicle, suspending or
5 decelerating the engine, and means for, in cases where a resultant
decrease in the sum of feedable electric power causes the sum of
feedable electric power to be lower than the sum of required
electric power, decreasing the sum of required electric power or
adjusting the interchange electric power to compensate for the
10 decrease in the sum of feedable electric power.

30. A power supply apparatus as recited in claim 29, wherein the
control portion includes means for judging whether or not the
vehicle is in the prescribed engine-drive-regulated region and the
15 present time is in a prescribed engine-drive-regulated time range,
and means for suspending or decelerating the engine when it is
judged that the vehicle is in the prescribed engine-drive-regulated
region and the present time is in the prescribed engine-drive-
regulated time range.

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31. An engine-drive-regulation supporting apparatus mounted on a
vehicle driven by an engine, the apparatus comprising:

engine-drive-regulated region detecting means including at
least one of means for judging whether or not the position of the
25 vehicle is in a prescribed engine-drive-regulated region on the basis
of information received from a vehicle position detecting device

provided on the vehicle or from an external with respect to the vehicle, and means for receiving an engine-drive-regulation signal from an external with respect to the vehicle; and

5 engine-drive regulating means for giving a notice to a vehicle driver, suspending the engine, or decelerating the engine when it is judged that the position of the vehicle is in the prescribed engine-drive-regulated region or in response to reception of the engine-drive-regulation signal.

10 32. An engine-drive-regulation supporting apparatus as recited in claim 31, wherein the engine-drive regulating means includes:

means for judging whether or not the vehicle is in the prescribed engine-drive-regulated region and the present time is in a prescribed engine-drive-regulated time range; and

15 means for giving the notice to the vehicle driver, suspending the engine, or decelerating the engine when it is judged that the vehicle is in the prescribed engine-drive-regulated region and the present time is in the prescribed engine-drive-regulated time range.

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33. A power supply apparatus as recited in claim 29, further comprising a manually-operated engine stop switch, and means provided in the control portion for stopping the engine in response to operation of the engine stop switch.